CLAIMS

1. A method of bioleaching a slurry containing sulphide minerals which includes the step of supplying a feed gas containing in excess of 21% oxygen by volume, to the slurry.

2. A method according to claim 1 wherein the feed gas contains in excess of 85% oxygen by volume.

3. A method according to claim 1 or 2 which includes the step of maintaining the dissolved oxygen concentration in the slurry within a desired range.

4. A method according to claim 3 wherein the said dissolved oxygen concentration is maintained in the range of from 0.2×10^{-3} kg/m³ to 10×10^{-3} kg/m³.

5. A method according to claim 3 or 4 wherein the dissolved oxygen concentration is maintained within a desired range by at least one of the following: controlling the oxygen content of the feed gas, controlling the supply of feed gas to the slurry, and controlling the rate of feed of slurry to a reactor.

6. A method according to claim 3, 4 or 5 wherein the dissolved oxygen concentration in the slurry is determined by one or more of the following: by direct measurement of the dissolved oxygen concentration in the slurry, by measurement of the oxygen in a gas above the slurry, and indirectly, by measurement of the oxygen content in off-gas from the slurry.

7. A method according to any one of claims 1 to 6 which includes the step of controlling the carbon content of the slurry.

8. A method according to claim 7 wherein the said carbon content is controlled by one or more of the following: the addition of carbon dioxide gas to the slurry, and the addition of other carbonaceous material to the slurry.

9. A method according to any one of claims 1 to 8 which includes the step of controlling the carbon dioxide content of the feed gas in the range of from 0.5% to 5.0% by volume.

10. A method according to any one of claims 1 to 9 which includes the step of bioleaching the slurry at a temperature in excess of 40 °C.

11. A method according to claim 10 wherein the said temperature is in the range of from 40°C to 100°C.

12. A method according to claim 11 wherein the said temperature is in the range of from 60°C to 85°C.

13. A method according to any one of claims 1 to 9 which includes the step of bioleaching the slurry at a temperature of up to 45°C using mesophile microorganisms.

14. A method according to claim 13 wherein the microorganisms are selected from the following genus groups: *Acidithiobacillus; Thiobacillus; Leptosprillum: Ferromicrobium;* and *Acidiphiiium.*

15. A method according to claim 13 or 14 wherein the said microorganisms are selected from the following species: *Acidithiobacillus caidus (Thiobacillus caldus); Acidithiobacillus thiooxidans (Thiobacillus thiooxidans): Acidithiobacillus ferrooxidans (Thiobacillus ferrooxidans); Acidithiobacillus acidophilus (Thiobacillus acidophilus); Thiobacillus prosperus; Leptospirillum ferrooxidans; Ferromicrobium acidophilus:* and *Acidiphilium cryptum.*

16. A method according to any one of claims 1 to 9 which includes the step of bioleaching the slurry at a temperature of from 45°C to 60°C using moderate thermophile microorganisms.

17. A method according to claim 16 wherein the microorganisms are selected from the following genus groups: *Acidithiobacillus* (formerly *Thiobacillus): Acidimicrobium; Sulfobacillus; Ferropiasma (Ferriplasma):* and *Alicyclobacillus.*

18. A method according to claim 16 or 17 wherein the said microorganisms are selected from the following species: *Acidithiobacillus caldus* (formerly *Thiobacillus caldus*); *Acidimicrobium ferrooxidans*; *Sulfobacillus acidophilus*; *Sulfobacillus disulfidooxidans*; *Sulfobacillus thermosulfidooxidans*; *Ferroplasma acidarmanus*; *Thermoplasma acidophilum*; and *Alicyclobacillus acidocaldrius*.

19. A method according to any one of claims 1 to 9 which includes the step of bioleaching the slurry at a temperature of from 60°C to 85°C using thermophilic microorganisms.

20. A method according to claim 19 wherein the microorganisms are selected from the following genus groups: *Acidothermus*; *Sulfolobus*; *Metallosphaera*; *Acidianus*; *Ferroplasma (Ferriplasma)*; *Thermoplasma*; and *Picrophilus*.

21. A method according to claim 19 or 20 wherein the said microorganisms are selected from the following species: *Sulfolobus metallicus*; *Sulfolobus acidocaldarius*; *Sulfolobus thermosulfidooxidans*; *Acidianus infernus*; *Metallosphaera sedula*; *Ferroplasma acidarmanus*; *Thermoplasma acidophilum*; *Thermoplasma volcanium*; and *Picrophilus oshimae*.

22. A method according to any one of claims 1 to 21 wherein the slurry is leached in a vessel which is substantially closed.

23. A method of bioleaching a slurry containing sulphide minerals which includes the steps of:

(a) bioleaching the slurry using suitable microorganisms at a temperature in excess of 40°C, and

(b) controlling the dissolved oxygen concentration in the slurry within a predetermined range.

24. A method according to claim 23 wherein the said dissolved oxygen concentration is controlled by controlling the supply of oxygen to the slurry.

25. A method according to claim 24 wherein the oxygen is supplied to the slurry in the form of oxygen enriched gas or substantially pure oxygen.

26. A method according to any one of claims 23 to 25 wherein the said temperature is in the range of from 60°C to 85°C.

27. A method of enhancing the oxygen mass transfer coefficient from a gas phase to a liquid phase in a sulphide mineral slurry which includes the step of supplying a feed gas containing in excess of 21% oxygen by volume, to the slurry.

28. A method according to claim 27 wherein the feed gas contains in excess of 85% oxygen by volume.

29. A method according to claim 27 or 28 which includes the step of raising the temperature of the slurry.

30. A method of bioleaching an aqueous slurry containing sulphide minerals which includes the steps of:

(a) bioleaching the slurry at a temperature above 40°C, and

(b) maintaining the dissolved oxygen concentration in the slurry in the range of from 0.2 x 10^{-3} kg/m³ to 10 x 10^{-3} kg/m³.

31. A method according to claim 30 wherein the dissolved oxygen concentration in the slurry is maintained by supplying gas containing in excess of 21% oxygen by volume to the slurry.

32. A method according to claim 30 or 31 wherein the temperature is in the range of from 60°C to 85°C.

33. A bioleaching plant which includes a reactor vessel, a source which feeds a sulphide mineral slurry to the vessel, an oxygen source, a device which measures the dissolved oxygen concentration in the slurry in the vessel, and a control mechanism whereby, in response to the said measured dissolved oxygen concentration, the supply of oxygen from the oxygen source to the slurry is controlled to achieve a dissolved oxygen concentration in the slurry within a predetermined range.

34. A plant according to claim 33 wherein the oxygen source supplies oxygen in a form of oxygen enriched air or substantially pure oxygen to the slurry.

35. A plant according to claim 33 or 34 wherein the reactor vessel is operated at a temperature in excess of 60°C.

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